ROBERT LEEDS

STRUCTURAL DESIGN

UNIT 4C RIVERSIDE AVENUE WEST, LAWFORD, MANNINGTREE, ESSEX CO11 1UN
TELEPHONE: +44 (0)1206 392 349. FACSIMILE: +44(0)870 836 2286
E-MAIL: info@robertleeds.co.uk INTERNET SITE: www.robertleeds.co.uk

Principal Robert R Leeds HNC Civil Eng HNC Building Construction
Associate Simon Eade HNC Civil Eng

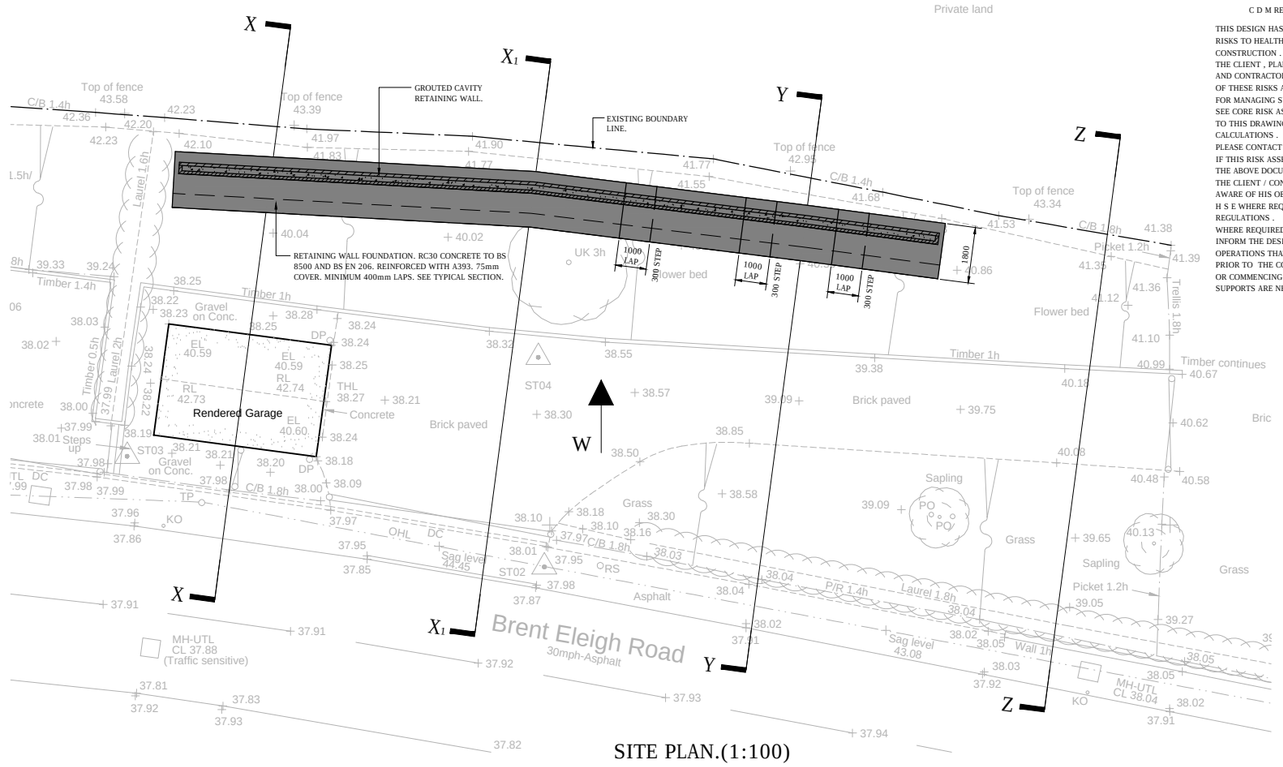
FENN COTTAGE MONKS ELEIGH
IPSWICH SUFFOLK IP7 7JG

CALCULATIONS FOR
RETAINING WALL

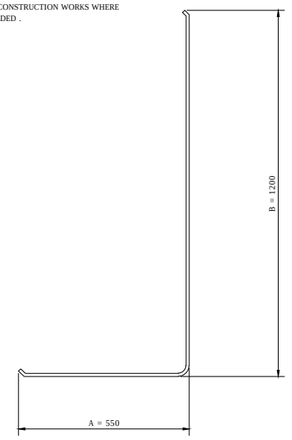
DRAWINGS: SEE DRAWING 2508/1

NOVEMBER 2023

If the following calculations are for submission to a Local Authority, or other checking engineers, for approval, no work should commence on works detailed in these calculations until the approval has been issued.



SITE PLAN.(1:100)



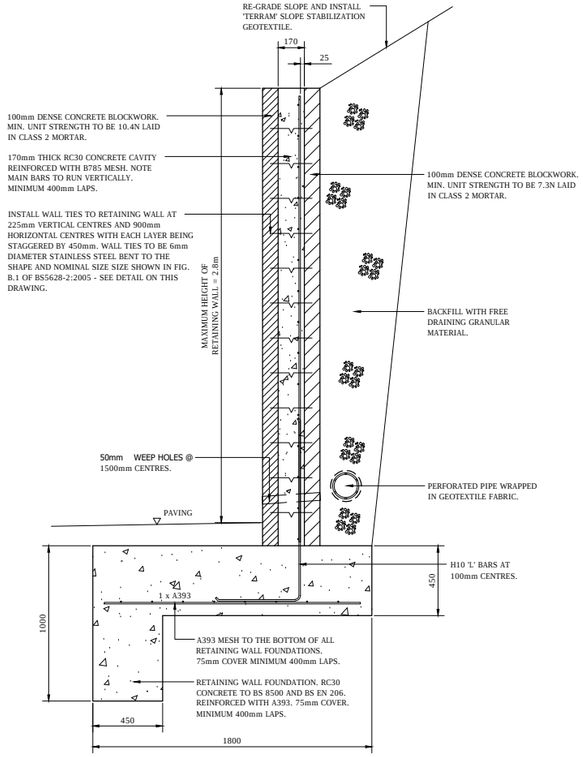
SHAPE CODE 11 TO BS8666:2005.
A = 550 B = 1200 LENGTH OF BAR = 1725mm

H10 'L' BARS.(1:10)

RETAINING WALL FOUNDATION STARTER BARS.

C D M REGULATIONS 2015

THIS DESIGN HAS BEEN PREPARED TO MINIMISE RISKS TO HEALTH AND SAFETY DURING CONSTRUCTION .
THE CLIENT , PLANNING SUPERVISOR AND CONTRACTOR SHOULD BE AWARE OF THESE RISKS AND MAKE PROVISIONS FOR MANAGING SUCH RISKS .
SEE CORE RISK ASSESSMENT ATTACHED TO THIS DRAWING OR INCLUDED IN THE CALCULATIONS .
PLEASE CONTACT THE DESIGNER / ENGINEER IF THIS RISK ASSESSMENT IS NOT WITHIN THE ABOVE DOCUMENTS .
THE CLIENT / CONTRACTOR SHOULD BE AWARE OF HIS OBLIGATION TO NOTIFY THE H S E WHERE REQUIRED UNDER THE C D M REGULATIONS .
WHERE REQUIRED THE CONTRACTOR SHOULD INFORM THE DESIGNER / ENGINEER OF ANY OPERATIONS THAT REQUIRE INSPECTION PRIOR TO THE COMPLETING OF THE OPERATION OR COMMENCING CONSTRUCTION WORKS WHERE SUPPORTS ARE NEEDED .



TYPICAL SECTION THRU RETAINING WALL.(1:20)

FOUNDATIONS - GENERAL NOTES

1. THE CONTRACTOR SHALL VERIFY ALL SITE AND SETTING OUT DIMENSIONS BEFORE ANY WORKS COMMENCE ON SITE WITH ANY DISCREPANCIES BEING REPORTED TO THE ENGINEER.

2. ALL FOUNDATIONS ARE TO BE TAKEN TO THE DEPTHS INDICATED ON THE DRAWINGS AND ARE TO BEAR ON UNDISTURBED SUBSOIL.

3. WHERE LOCALISED CHANGES IN STRATA GIVE RISE TO DIFFERENCES IN BEARING CAPACITY SPECIAL PRECAUTIONS WILL BE NECESSARY. AT SOFT SPOTS EXCAVATIONS SHOULD BE DEEPENED LOCALLY TO A SOUND BOTTOM OR, ALTERNATIVELY REINFORCED. HARD SPOTS SHOULD BE REMOVED. ANY LOCALISED CHANGES IN STRATA SHOULD BE REPORTED TO THE ENGINEER IMMEDIATELY.

4. WHEN A TRENCH IS EXCAVATED IN CLAY SUB-SOILS, THE BASE OFTEN HAS SOME TOOTH MARKS IN IT MADE BY THE EXCAVATOR BUCKET. PROVISED THAT THE CLAY SOIL BETWEEN THE TOOTH MARKS IS NOT LOOSE IN THE TRENCH BASE THERE IS NO NEED TO BOTTOM OUT THE TRENCH BY HAND. IF HOWEVER THERE IS ANY LOOSE SOIL IT SHOULD BE REMOVED.

5. IMMEDIATELY A TRENCH IS EXCAVATED IN CLAY SOIL THE STRIP FOOTING OR TRENCH FILL CONCRETE SHOULD BE PLACED (PREFERABLY THE SAME DAY) TO AVOID THE CLAY BASE EITHER DRYING OUT OR BECOMING WET.

6. WHERE TRENCH BOTTOMS BECOME EXCESSIVELY DRIED OR SOFTENED DUE TO RAIN OR GROUND WATER, THE EXCAVATION SHOULD BE RE-BOTTOMED PRIOR TO CONCRETING.

7. CONCRETE MUST NOT BE POURED IN STANDING OR FLOWING WATER IN A TRENCH.

8. UNDER THE CDM REGULATIONS ALL PERSONAL MUST BE MADE AWARE OF THE REQUIREMENTS UNDER THE HEALTH AND SAFETY PLAN FOR ENTERING TRENCHES, ESPECIALLY WHERE GROUND INSTABILITY MAY OCCUR OR TRENCH DEPTH EXCEEDS 1.2m.

9. EXCAVATIONS OVER 1.2m DEEP TO BE SHORED AGAINST COLLAPSE.

10. STEPS IN FOUNDATIONS ARE NOT TO EXCEED 0.5m.

11. IT IS RECOMMENDED THAT PLAIN UNREINFORCED CONCRETE MADE WITH ORDINARY PORTLAND CEMENT IS LEFT FOR AT LEAST 4 DAYS TO CURE PRIOR TO PROCEEDING WITH SUB-STRCUTURE MASONRY.

12. FOR TRENCH FILL FOUNDATIONS IN CLAY SUB SOIL ANTI-HEAVE PRECAUTIONS ARE TO BE PROVIDED FOR FOUNDATIONS THAT ARE 1.5m DEEP OR GREATER AND ARE TO TERMINATE 500mm ABOVE FORMATION ALL IN ACCORDANCE WITH NHBC GUIDE LINES CHAPTER 4.2 - 'BUILDING NEAR TREES'.

13. DAY JOINTS. CONSTRUCT DAY JOINTS USING 6NO. H20 BARS 600mm LONG. NOTE DAY JOINTS ARE NOT TO OCCUR ON CORNERS OR AT STEPS. JOINTS SHOULD BE POSITIONED A MIN. OF 1.0m AWAY FROM ANY CORNER OR STEP.

14. UNLESS INDICATED OTHERWISE MASS CONCRETE FOUNDATIONS AND TRENCH FILL FOUNDATIONS TO BE GEN3 CONCRETE TO BS 8500 AND BS EN 206. MINIMUM COMPRESSIVE STRENGTH 20N/mm².

DESIGNATED CONCRETE MIXES TO BS 8500 & BS EN 206

DESIGNATED MIX	COMPRESSIVE STRENGTH (N/mm²)	STRENGTH CLASS	TYPICAL APPLICATION	MINIMUM CEMENT CONTENT (kg/m³)	MAX. FREE WATER/ CEMENT RATIO	TYPICAL SLUMP (mm)	CONSISTENCE CLASS
GEN 0	7.5	C-/17.5	KERB BEDDING AND BACKING.	120	N/A	NOMINAL 10	S1
GEN 1	10	CB/10	BLINDING AND MASS CONCRETE FILL. DRAINAGE WORKS. OVERSITE BELOW SUSPENDED SLABS.	180 180 180	N/A N/A N/A	75 10-50 75	S3 S1 S3
GEN 3	20	C16/20	MASS CONCRETE FOUNDATIONS. TRENCHFILL FOUNDATIONS.	220 220	N/A N/A	75 125	S3 S4
FND 2,3 4 OR 4A	35	C28/30	FOUNDATIONS IN SULPHATE CONDITIONS 2, 3, 4 OR 4A.	320-380	0.5-0.35	75	S3
RC30	30	C25/30	REINFORCED CONCRETE	260	0.65	50-100	S3
RC35	35	C28/30		280	0.60	50-100	S3
RC40	40	C32/40		300	0.55	50-100	S3
RC50	50	C40/50		340	0.45	50-100	S3

WHERE STRENGTH CLASS C28/35 INDICATES THAT THE MINIMUM CHARACTERISTIC CYLINDER STRENGTH IS 28N/mm² AND CUBE STRENGTH 35N/mm².

SOURCE: BS EN 206: PART 1: 2004: TABLE A, 13 ADAPTED.

15. FOR BURIED CONCRETE IN AGGRESSIVE GROUND, CONCRETE SHALL BE DESIGNED IN ACCORDANCE WITH BRE SPECIAL DIGEST 1:2005. (SD1:2005)

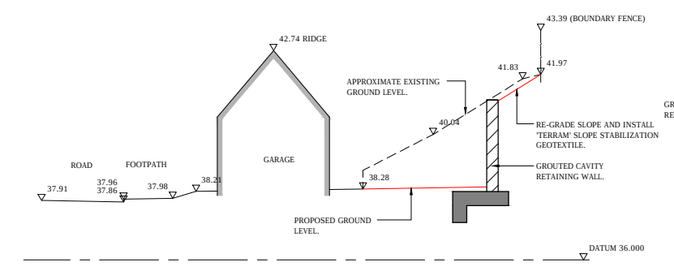
16. ANY UNEXPECTED SITE CONDITIONS ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY SO THAT THE DESIGN CAN BE REVIEWED AND ALTERED IF NECESSARY.

17. THE CONTRACTOR IS RESPONSIBLE AND LIABLE FOR ENSURING THE STABILITY OF THE WORKS AND SERVICES AT ALL STAGES OF CONSTRUCTION, UNLESS SHOWN ON THE PROJECT DRAWINGS, WE HAVE NO KNOWLEDGE OF EXISTING UNDERGROUND SERVICES OR OBSTRUCTIONS.

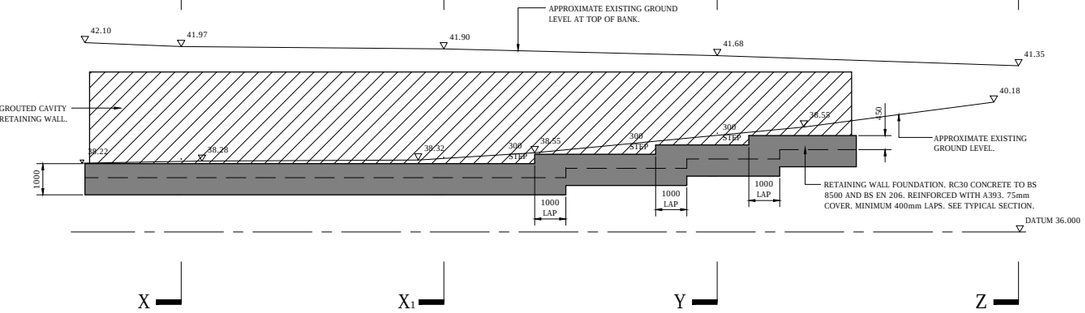
18. REMAINING TREES. IN ORDER TO AVOID UNACCEPTABLE DAMAGE AS A RESULT OF CONSTRUCTION ACTIVITY, AN AREA AROUND EACH REMAINING TREE SHOULD BE PROTECTED FROM DISTURBANCE BY FENCING. THIS SHOULD NOT BE REMOVED OR BREACHED DURING CONSTRUCTION OPERATIONS WITHOUT PRIOR CONSULTATION WITH AN ARBORICULTURAL SPECIALIST. THE FENCING SHOULD PROTECT AS LARGE AN AREA AROUND THE TREE AS POSSIBLE AFTER CONSIDERATION OF ALL CONSTRUCTION OPERATIONS IN THE VICINITY. FURTHER GUIDANCE IS GIVEN IN BS5837.

19. THE TYPE AND GRADE OF STEEL REINFORCEMENT SHALL BE DESIGNATED AS FOLLOWS:

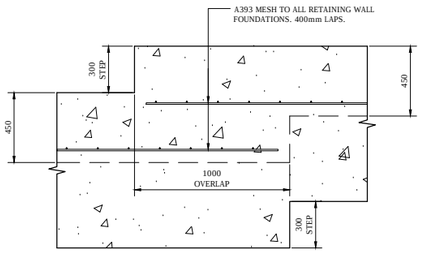
TYPE OF STEEL REINFORCEMENT	NOTATION
GRADE B500A, GRADE B500B OR GRADE B500C CONFORMING TO BS 4449:2005	H
GRADE B500A CONFORMING TO BS 4449:2005	A
GRADE B500B OR GRADE B500C CONFORMING TO BS 4449:2005	B
GRADE B500C CONFORMING TO BS 4449:2005	C
A SPECIFIED GRADE AND TYPE OF RIBBED STAINLESS STEEL CONFORMING TO BS 6744:2001	S
REINFORCEMENT OF A TYPE NOT INCLUDED IN THE ABOVE LIST HAVING MATERIAL PROPERTIES THAT ARE DEFINED IN THE DESIGN OR CONTRACT SPECIFICATION.	X
NOTE: IN THE GRADE DESCRIPTION B500A ETC., "B" INDICATES REINFORCING STEEL.	



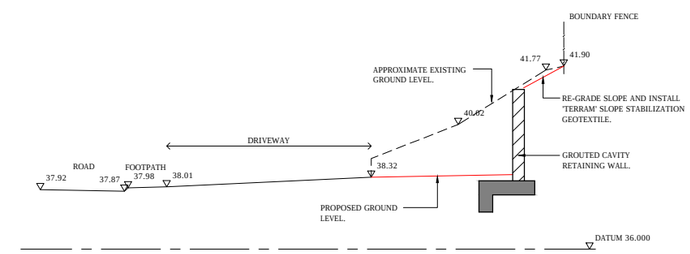
SECTION X - X.(1:100)



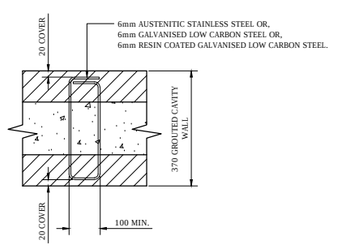
ELEVATION AT 'W'.(1:100)



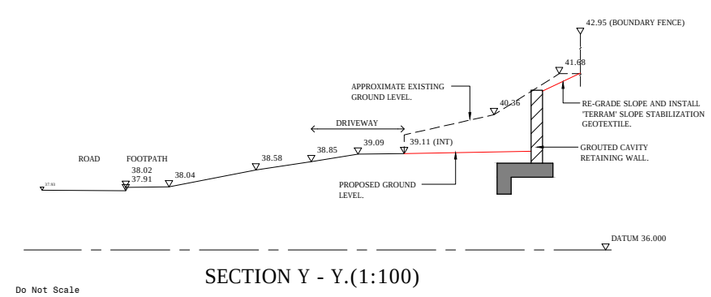
FOUNDATION OVERLAP.(1:20)



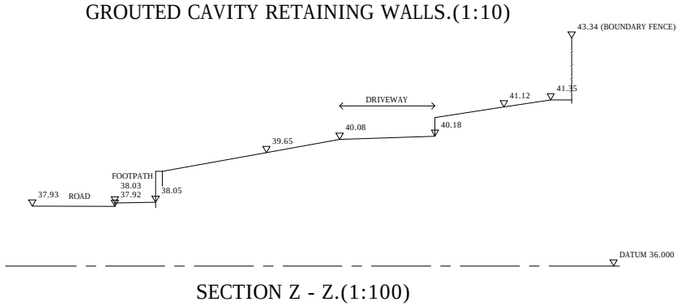
SECTION X1 - X1.(1:100)



BS 5628-2:2005 FIG. B.1 WALL TIES FOR HIGH LIFT GROUTED CAVITY RETAINING WALLS.(1:10)

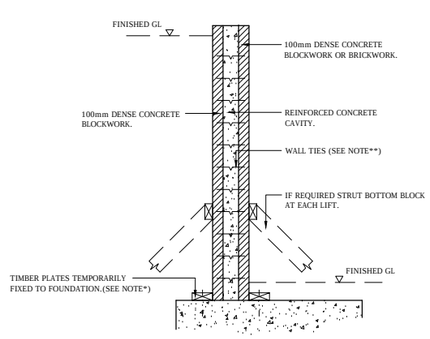


SECTION Y - Y.(1:100)



SECTION Z - Z.(1:100)

CONSTRUCTING GROUTED CAVITY RETAINING WALLS



ENSURE FIRST RUN OF WALL TIES ARE INSTALLED AT THE TOP OF THE FIRST COURSE OF BLOCKS. WALL TIES TO BE INSTALLED IN ACCORDANCE WITH THE RECOMMENDATIONS LAID DOWN IN BS5628-2:2005. 'STRUCTURAL USE OF REINFORCED MASONRY'.

**WALL TIES TO BE OF THE TYPE, SIZE AND CONFIGURATION RECOMMENDED IN BS5628-2:2005.

*TIMBER PLATE TEMPORARILY FIXED TO RETAINING WALL FOUNDATION TO PREVENT SLIDING OF THE FIRST BLOCK COURSE WHEN CONCRETING IS TAKING PLACE.

ENSURE THAT BOTH BLOCKWORK SKINS ARE BROUGHT UP IN UNISON. BLOCKWORK TO BE BROUGHT UP IN SHORT LIFTS WITH THE CAVITY FOR EACH LIFT BEING CONCRETED BEFORE COMMENCEMENT OF THE NEXT LIFT. ENSURE THE START OF EACH LIFT OCCURS AT A TIED COURSE.

ENSURE BLOCKWORK SKINS ARE CURED TO A SUFFICIENT STRENGTH BEFORE FILLING WITH CONCRETE. AFTER THE CAVITY HAS BEEN FILLED ENSURE CONCRETE HAS CURED SUFFICIENTLY BEFORE COMMENCEMENT OF THE NEXT LIFT.

ENSURE THE CONCRETE MIX IS KEPT AS DRY AS POSSIBLE CONDUCIVE WITH ITS COMPACTION. CONCRETE IS TO BE PLACED CAREFULLY IN THE CAVITY TAKING CARE TO ENSURE IT IS NOT DROPPED INTO THE CAVITY FROM AN EXCESSIVE HEIGHT.

A FULL 28 DAYS SHOULD BE ALLOWED FOR AFTER THE LAST POUR BEFORE ANY BACKFILL LOADS ARE APPLIED TO THE WALL.

THE CONTRACTOR IS RESPONSIBLE AND LIABLE FOR THE STABILITY OF ALL WORKS AT ALL STAGES OF CONSTRUCTION. ENSURE ALL TEMPORARY PROPPING AND SHORING IS ADEQUATELY FOUNDED AT ALL STAGES OF CONSTRUCTION. WHERE REQUIRED BY THE RISK ASSESSMENTS METHOD STATEMENTS SHALL BE PREPARED FOR THE TEMPORARY WORKS AND SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO COMMENCEMENT OF ANY WORKS.

Rev'n Date Amendments

ROBERT LEEDS

STRUCTURAL DESIGN
BLOCK 4, UNIT 4C, RIVERSIDE AVENUE WEST, LAWFORD. CO11 1UN
TELEPHONE: +44 (0)1206 392349 FAX: 0870 8362286
E-MAIL: info@robertleeds.co.uk INTERNET SITE: www.robertleeds.co.uk

Project

FENN COTTAGE MONKS ELEIGH IPSWICH IP7 7JG.

Drawing Title

RETAINING WALL TO FRONT DRIVEWAY.

Drawn By: S.E.
Scales: AS SHOWN @ A1
Date: NOV. 2023
C.A.D. Reference: 2508 Model.dwg
Drawing Number: 2508 / 1

Do Not Scale

ROBERT LEEDS STRUCTURAL DESIGN (01206) 392349
UNIT 4C RIVERSIDE AVENUE WEST LAWFORD CO11 1UN
FENN COTTAGE MONKS ELEIGH IPSWICH IP7 7JG

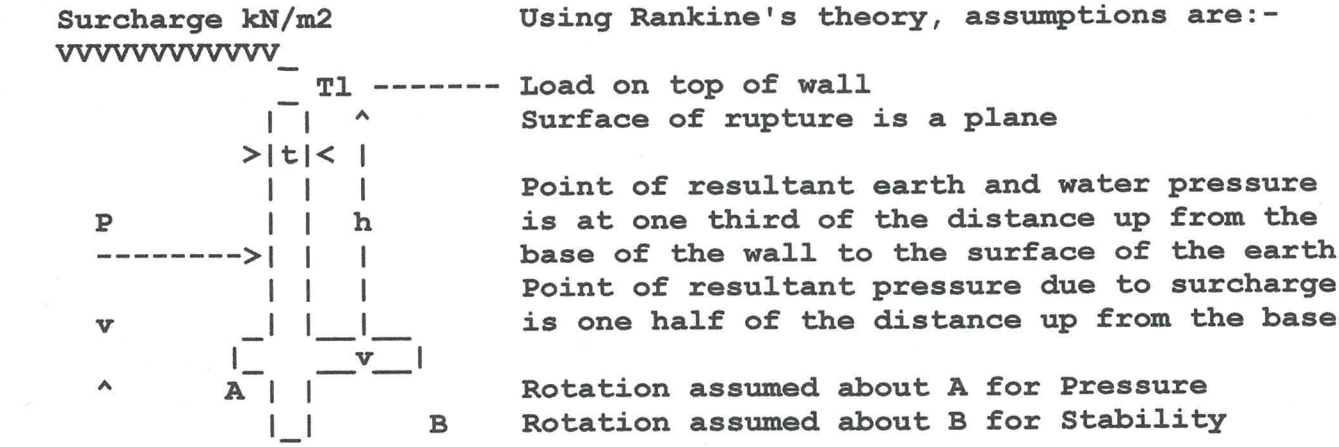
Made by: S.E.
Date: 06.11.23
CALCULATIONS FOR RETAINING WALL
Ref No: MISC

Office: 1014

EARTH RETAINING WALL WITH OR WITHOUT WATER PRESSURE

Ref RETWALL.PRO R R Leeds 1990

Location : S.E.



Rankine gives the formula for the resultant earth pressure on the back of the wall as P = Ce.w.h^2/2 where Ce is a pressure coefficient.

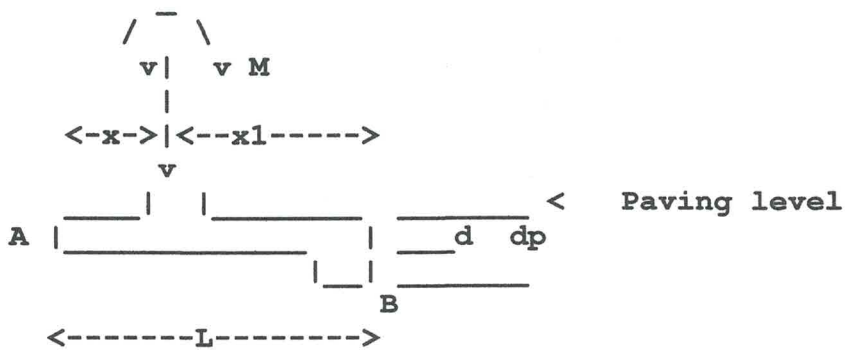
A general partial factor of 1.5 is applied to all forces to determine reinforcement etc

Weight/unit vol of retained soil : w=18 kN/m3
Surcharge loading : su=2.5 kN/m2
Height of wall : h=2.8 m
Additional VERTICAL load if any : Tl=0 kN/m
Internal friction angle of soil : phi=30 degrees
Thickness of wall : t=0.37 m
Height of soil behind wall : sh=2.8 m
Pressure coefficient : k2=(1-SIN(RAD(phi)))/(1
+SIN(RAD(phi)))
=(1-SIN(RAD(30)))/(1+SIN(RAD(30)))
=0.33333
Equivalent height for surcharge : he=(su/w)+h=(2.5/18)+2.8
=2.9389 m
Earth pressure at base : pes=k2*w*he=0.33333*18*2.9389
=17.633 kN/m2/m
Resultant force due to pressure : P=k2*w*he^2/2=0.33333*18*2.9389^2/2
=25.911 kN/m run
Any BM due to other load : AB=0 kNm/m
Maximum B.M. at base of stem : M=(P*h/3)+AB=(25.911*2.8/3)+0
=24.184 kNm/m
Factored B.M. for BS8110 say : Mf=M*1.5=24.184*1.5=36.276 kNm/m
Maximum S.F. at base of stem : S=P=25.911 kN/m
Factored S.F. : Sf=S*1.5=25.911*1.5=38.867 kN/m
Weight of wall + Additional load : v=(h*t*24)+Tl=(2.8*0.37*24)+0
=24.864 kN/m run

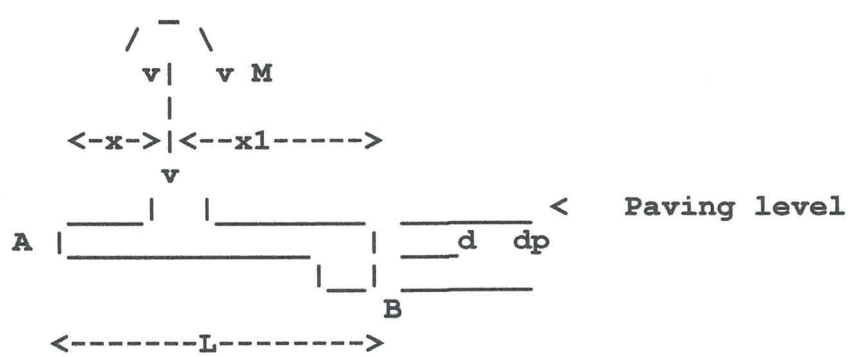
The frictional force between soil and wall stem is ignored.

Office: 1014

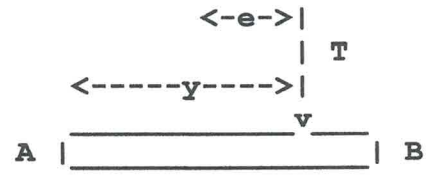
BASE DESIGN



Thickness of base : d=0.45 m
Length of base : L=1.8 m
Distance to centre of stem : x=0.52 m
Allowable ground pressure : p=50 kN/m^2
Depth of toe for passive resist : dp=1 m
Distance stem to front toe : x1=L-x=1.8-0.52=1.28 m
Self weight of foundation : Sw=L*d*24=1.8*0.45*24=19.44 kN/m run
Weight of soil at back of wall : wb=sh*(x-t/2)*w=2.8*(0.52-0.37/2)*18
=16.884 kN
Total load on soil : T=v+Sw+wb=24.864+19.44+16.884
=61.188 kN



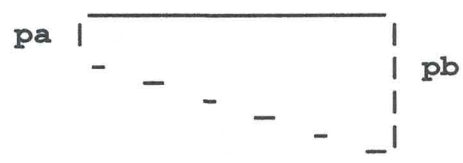
Clockwise moments about A : Mc=v*x+M+Sw*L/2+wb*(x-t/2)/2
=24.864*0.52+24.184+19.44*1.8/2+16.884
*(0.52-0.37/2)/2
=57.437 kNm
Distance to load centroid : y=Mc/T=57.437/61.188=0.9387 m



Eccentricity : e=y-L/2=0.9387-1.8/2=0.038699 m

Office: 1014

Centroid of load lies within middle third. Pressure varies from a minimum of pa at A to a maximum of pb at B.



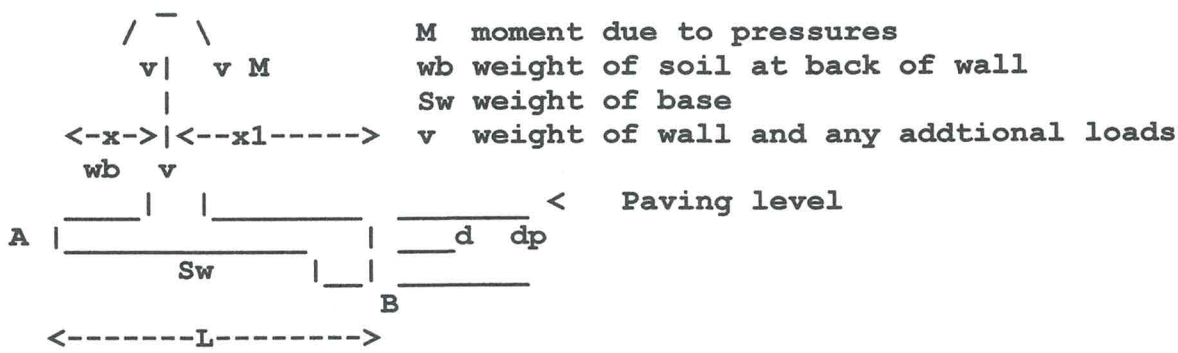
Base area modulus : z=1*L^2/6=1*1.8^2/6=0.54 m3/m run
Pressure at A : pa=T/(L*1)-T*e/z
=61.188/(1.8*1)-61.188*0.038699
/0.54
=29.608 kN/m^2
Pressure at B : pb=T/(L*1)+T*e/z
=61.188/(1.8*1)+61.188*0.038699
/0.54
=38.378 kN/m^2
Pressure beneath base within allowable.
Pressure under slab at wall : pw=pa+(pb-pa)*x/L
=29.608+(38.378-29.608)*0.52/1.8
=32.142 kN/m^2
Factored BM in slab at wall : Mw=((pw-24*d)*x1^2/2+(pb-pw)*x1^2/3)*1.5
=((32.142-24*0.45)*1.28^2/2+(38.378
-32.142)*1.28^2/3)*1.5
=31.334 kNm

RESISTANCE TO SLIDING

Frictional resistance : F=0.4*T=0.4*61.188=24.475 kN/m run
Internal friction angle of soil
For passive resistance at toe : phis=30 degees
Coefficient of passive pressure : Kp=(TAN(RAD(45)+RAD(phis/2)))^2
=(TAN(RAD(45)+RAD(30/2)))^2
=3
Passive reaction : R=0.5*Kp*w*dp^2=0.5*3*18*1^2
=27 kN/m
Factor of safety against sliding : FOS=(F+R)/S=(24.475+27)/25.911
=1.9866

Office: 1014

STABILITY AGAINST OVERTURNING



Overturning Moment : OTM=M=24.184 kNm/m

Restoring Moment Rotation about B

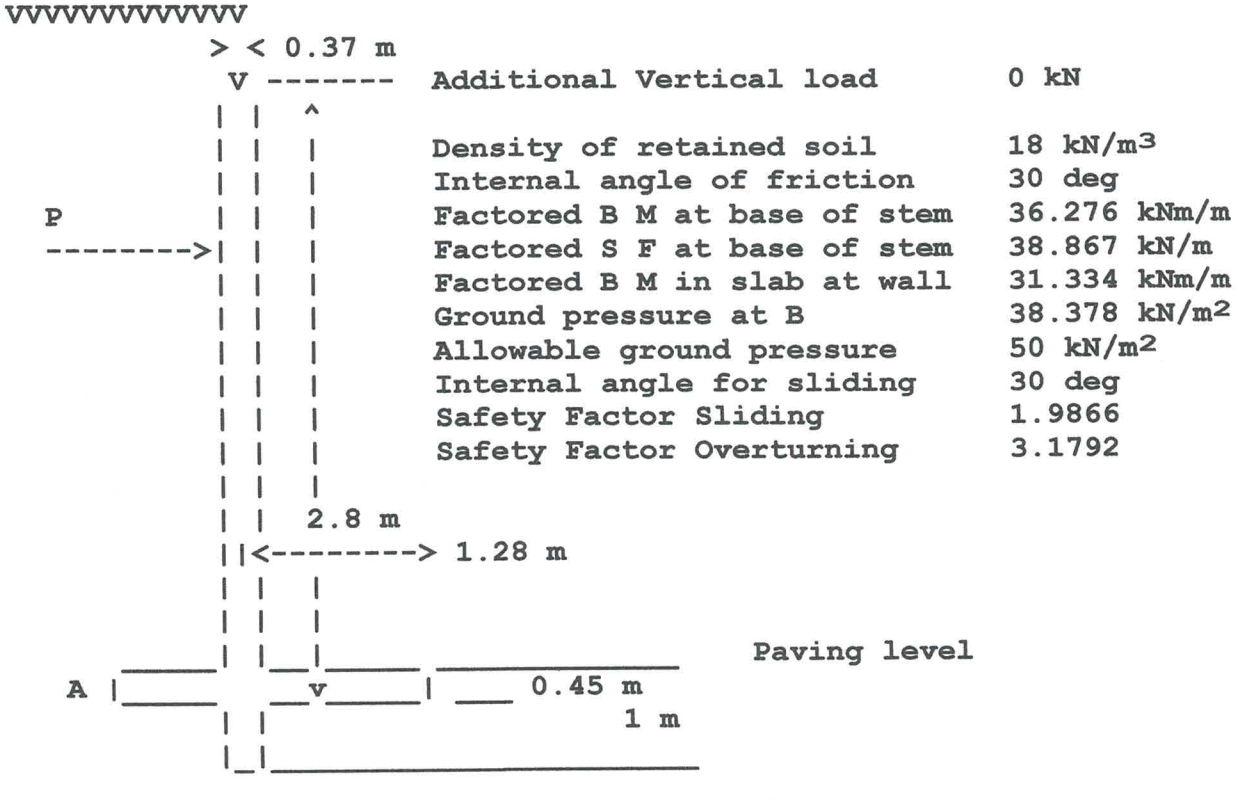
: RM=v*(L-x)+(Sw*L/2)+(wb*(L-((x-t/2)/2)))
=24.864*(1.8-0.52)+(19.44*1.8/2)+(16.884
*(1.8-((0.52-0.37/2)/2)))
=76.885 kNm/m

Safety factor against overturning is :

: SFOT=RM/OTM=76.885/24.184=3.1792

Eccentricity is within limiting value.

SUMMARY OF RETAINING WALL



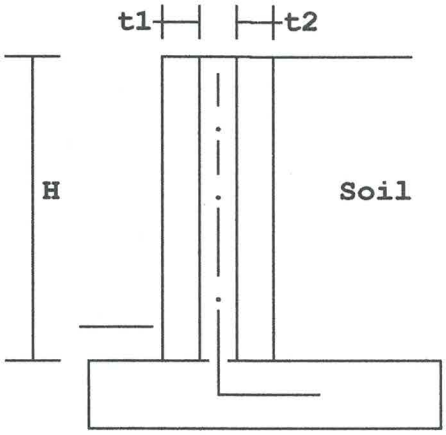
Additional Vertical load	0 kN
Density of retained soil	18 kN/m3
Internal angle of friction	30 deg
Factored B M at base of stem	36.276 kNm/m
Factored S F at base of stem	38.867 kN/m
Factored B M in slab at wall	31.334 kNm/m
Ground pressure at B	38.378 kN/m2
Allowable ground pressure	50 kN/m2
Internal angle for sliding	30 deg
Safety Factor Sliding	1.9866
Safety Factor Overturning	3.1792


B
1.8 m

**

Location: FRONT DRIVEWAY RETAINING WALL

Wall and loading details



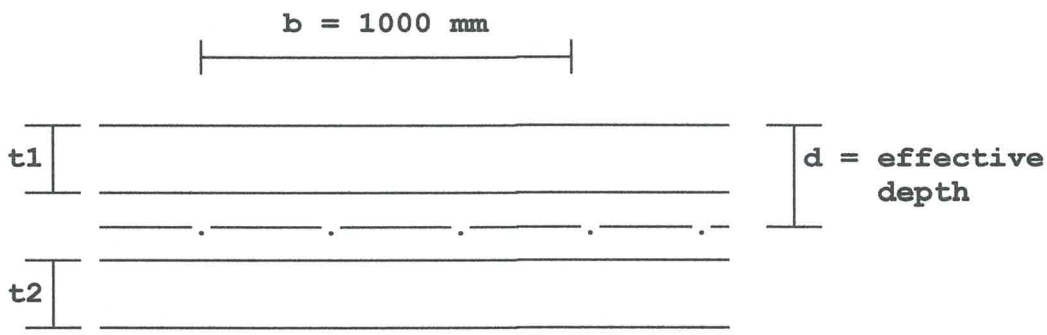
Reinforced masonry retaining wall to

BS5628-2:2005

Cavity to be filled with concrete or grout of C25/30 minimum compressive strength. Cavity width to be a minimum of 100 mm and earth face leaf to be ≥ 100 mm thick. Concrete base design is beyond the scope of this proforma.

Outer skin thickness	t1=100 mm
Earth face skin thickness	t2=100 mm
Wall height	H=2.8 m
Cavity width (minimum 100 mm)	cw=170 mm
Ultimate moment at top of base	Mu=36.276 kNm
Ultimate shear at top of base	Vu=38.867 kN

Effective depth



Plan on wall

Effective depth of reinforcement d=t1+cw/2=100+170/2=185 mm
Effective width of wall b=1000 mm
The effective depth d > H/18, hence the limiting ratio of the span to effective depth as required by Table 5.2 is satisfactory.
Mortar designation to Table 1 mortar=2

Masonry details

Outer Leaf:

Masonry type (1=clay 2=cal silicate 3=conc brick 4=block) typ(1)=4

Height of units	hb=215 mm
Least horiz. dimension of units	lhd=100 mm
ratio height/least horiz. dim	rb=hb/lhd=215/100=2.15
Compressive strength of units	po(1)=10.4 N/mm²
Char comp strength - Table 3(d)	fk(a)=TABLE 3.3 for mortar=2, po=10.4 =8.4 N/mm²
Partial safety factor (reinft.)	gammam=2.3

Steel reinforcement details

Characteristic tensile strength	fy=500 N/mm²
Partial safety factor (Table 8)	gammas=1.15
Diameter of reinforcing bars	diam=10 mm

Resistance moment of section based on masonry

Md=0.4*fk(a)*b*d^2/(gammam*10^6)
=0.4*8.4*1000*185^2/(2.3*10^6)
=49.998 kNm

Bending strength

compute B=fy*d/gammas=500*185/1.15
=80435

compute A=(fy^2*gammam*0.5)/(gammas^2*b*fk(a))
=(500^2*2.3*0.5)/(1.15^2*1000*8.4)
=25.88

Area of reinforcement As=(B-SQR((B^2)-4*A*Mu*10^6))/(2*A)
=(80435-SQR((80435^2)-4*25.88
*36.276*10^6))/(2*25.88)
=547.42 mm²

Area of reinforcing bar Abar=PI*diam^2/4=3.1416*10^2/4
=78.54 mm²

No of bars required Bars=INT(As/Abar)+1
=INT(547.42/78.54)+1
=7

No of bars to be provided Bars=10

Use 10 No 10 mm diam bars.

Actual area of reinforcement used Aac=Bars*Abar=10*78.54=785.4 mm²/m

In order to ensure a ductile failure the moment of resistance MoR based on reinforcement provided needs to be less than the moment of resistance Md based on masonry.

Lever arm z=d*(1-(0.5*Aac*fy*gammam/(b*d*fk(a)*gammas)))
=185*(1-(0.5*785.4*500*2.3/(1000*185*8.4*1.15)))
=138.25 mm

Moment of resistance (based on reinforcement)
MoR=Aac*fy*z/(gammas*1000000)
=785.4*500*138.25/(1.15*1000000)
=47.209 kNm

Since Mu < MoR the applied moment is less than the moment of resistance based on reinforcement provided. Furthermore, MoR < Md and therefore Clause 8.2.4.2.1 of the code is satisfied.

Longitudinal bars

Provide some longitudinal bars to tie the the main vertical bars together for ease of construction. The spacing of the longitudinal bars should not exceed 500 mm. The minimum area of secondary steel according to BS5628-2:2005 is 92.5 mm²/m

Shear strength of masonry

Ratio	rat=Aac/(b*d)=785.4/(1000*185) =0.0042454
Characteristic shear strength	fv=0.35+17.5*rat=0.35+17.5*0.0042454 =0.42429 N/mm²
Partial safety factor (shear)	gammav=2.0
Shear strength divided by FoS	f1=fv/gammav=0.42429/2=0.21215 N/mm²
Shear stress due to loading	v=Vu*1000/(b*d) =38.867*1000/(1000*185) =0.21009 N/mm²

Shear reinforcement is not required.

Local bond

Char anchorage bond strength	fb=4.1 N/mm²
Partial safety factor for bond	gammab=1.5
Sum of the perimeters of the bars	Sum=PI*diam*Bars=3.1416*10*10 =314.16 mm
Ratio of bond strength to FoS.	fbs=fb/gammab=4.1/1.5=2.7333
Ratio of shear force to Sum	Ratio=Vu*1000/(Sum*d) =38.867*1000/(314.16*185) =0.66874

Local bond stress is satisfactory.

DESIGN SUMMARY

Ultimate bending moment	36.276 kNm
Ultimate shear force	38.867 kN
Wall effective depth	185 mm
Wall effective width	1000 mm
Maximum wall height	2.8 m
Tensile strength of reinft.	500 N/mm²
Mortar designation	2
Compressive strength of units	10.4 N/mm²
Area of reinforcement in wall	785.4 mm²/m
Diameter of reinforcing bars	10 mm
Partial safety factors:	
Masonry	2.3
Reinforcement strength	1.15
Shear strength of masonry	2
Bond strength	1.5

The design of the concrete base is beyond the scope of this proforma. Brick or block could be used for the earth face leaf.

SITE: FENN COTTAGE MONKS ELEIGH IPSWICH IP7 7JG	**OPERATION: GROUTED CAVITY RETAINING WALL**

GENERAL REQUIREMENTS OF CONSTRUCTION.

The contractor should have experience in the various operations and method of construction indicated below.

EXCAVATIONS		**CONCRETE WORKS**		**PILING**	
Trial pits/locations of services	√	Screeding		Driven	
Soil investigation		Mass concrete	√	Sheet	
Trench 0.5 – 1M	√	Steel reinforced concrete	√	Cast insitu concrete	
Trench 1 – 2M		Fixing reinforcement	√	CFA	
Trench 2 – 3M		Special reinforcement	√	Sleeved	
Deeper than 3M		Timber formwork		Vibro compaction	
Large sumps		Purpose made formwork		Near structures/highways	
Below water table	√	Shuttered concrete	√	Specialist system	
Tunneling		Placing near adjacent structures	√		
De-watering	√	Placing near adjacent highway	√	**MASONRY**	
Strutted support		Placing under water			
Closed sheeting		Placing tidal		Faced	√
Adjacent structures	√	Shuttered above ground level	√	General load bearing	√
Adjacent highways	√	Shuttered below ground level	√	Reinforced	
Near underground services	√	Mixing onsite specified mix		Grouted cavity	√
		Placing at ground level	√	Special control	
GENERAL FOUNDATIONS		Placing above ground level	√		
		Placing below ground level	√	**STRUCTURAL STEELWORK**	
Trench 1 – 2M	√	Placing suspended slabs			
Trench 2 – 3M		Placing vertical columns		Fabrication of steels, frames and beams	
Deeper than 3M		Pumping	√	Preparation of fabrication details	
Pads with bolt fixings		Cutting/drilling	√	Erection and bracing steelwork	
Pad and beam		Breaking		Crainage for erection	
Pile and beam		Mechanical/chemical fixings	√	Sheeting and cladding	
Ground bearing raft		Repairs			
Piled slab				**STRUCTURAL TIMBER**	
Slab floor/roads		**STRUCTURAL ALTERATIONS & NEW WORKS**			
Adjacent structures	√			General structural timber work	√
Adjacent highway	√	Supports off ground	√	Trussed rafters and structural timbers	
		Supports off structure		Timber beams including flitch construction	
UNDERPINNING		Support of walls with props and needles		Structural details and calculations	
		Support of floor/roof with props		Erection and bracing trussed rafters	
Piled slab		Support of concrete slabs and floors		Crainage for placing	
Sacrificial propping		Insertion of new beams/columns			
Temporary propping		Erection/insertion structural frames		**PRE-STRESSED & PRECAST CONCRETE ELEMENTS**	
Restraint of masonry walls		Structural trimming of floors/roofs			
Mini piling		Structural trimming of concrete slabs		Structural details and calculations	
Jack down piling		Horizontal restraint/support of wall panels		Erection procedures and bracing	
Adjacent structures		Erection of shoring		Crainage for placing	
Adjacent highway		Lifting/movement of heavy members	√		
Restricted access		Vehicle/pedestrian bridges/ramps	√	**DRAINAGE**	
Hit and miss block					
		SCAFFOLDING		Porous drains	√
				Diversion works	
		Erection of scaffolding to BS5973		Foul	
				Surface water	

4C RIVERSIDE AVENUE WEST, LAWFORD, ESSEX, CO11 1UN.
TEL: 01206 392349

SITE: FENN COTTAGE MONKS ELEIGH IPSWICH IP7 7JG					**OPERATION: GROUTED CAVITY RETAINING WALL**		
DISCIPLINE (tick box)	1	2	3	4	**PERSONAL PROTECTIVE EQUIPMENT**	Yes	No
					Barrier cream		√
No of workers exposed to hazard					Safety footwear	√	
1, 1-5, 2. 6-10, 3. 11-20, 4. 20-30	√						
					SPECIALIST EQUIPMENT		
Potential severity of injury/illness							
1. First aid, 2. Reportable, 3. Major, 4 . Fatal.		√			Buoyancy aids		√
					Gas detector		√
Probability of injury or illness 1. Low, 2. Medium, 3. High	√				Rescue equipment		√
					Fluorescent jackets	√	

SITE HAZARDS AND REQUIREMENTS	Yes	No			
			HAZARDS		
Flooding		√			
Occupied school		√	Falls - up to 2 metres	√	
Occupied factory		√	- over 2 metres		√
Occupied building		√	- into holes etc	√	
Disproportionate collapse		√	- of materials	√	
Demolition works – major		√	Struck : by moving vehicles	√	
Demolition works – minor	√		flying/falling objects	√	
Adjoining structures			Contact with moving machinery	√	
Support of structure	√		Striking against something fixed/stationary	√	
Special support - highways	√		Slip/trip on same level	√	
- buildings	√		Trapped by ; plant	√	
Contamination		√	transport	√	
Gases		√	something overturning	√	
Poor headroom		√	Drowning		√
Poor ground stability	√		Asphyxiation		√
Other contractors encroaching		√	Exposure to/or contact with harmful substance		√
Work near public areas/footpaths	√		Exposure to : fire/explosion		√
Work near/over water		√	electricity	√	
Overhead power cables		√	noise	√	
Overhead services	√		Manual handling	√	
Overhead cables - electric (check)	√		Pushing, pulling and carrying	√	
BT (check)	√		Confined spaces		√
Water (check)	√		Other specific risks? State.		√
British Gas (check)	√		Equipment necessary		
Other underground services (check)	√		Access equipment		√
Travelling/working on ramps	√		Task lighting		√
Permit to work	√		Edge protection		√
Warning signs	√		Warning signs	√	
Training	√		Certified crane/lifting gear		√
Competency certificate	√		Piling		√
			Heading/pipe jacking		√
PERSONAL PROTECTIVE EQUIPMENT			Props permanent		√
			Props temporary	√	
Helmet	√		Trench sheeting	√	
Ear protection		√	Pumps	√	
Eye protection/goggles/visor	√		Scaffolding		√
Overalls		√	Scaffolding certificate		√
Wet suits		√	Compaction equipment	√	
Safety harness		√	Dumper	√	
Masks/respirators		√	Mechanical digger	√	
Gloves		√	Cement mixer	√	

\# Items that require a Method Statement by contractor for designers comments.

* Designer to visit site to approve structural supports prior to commencement of works